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## (12) United States Patent Kim et al.

# (54) 3D SEMICONDUCTOR INTEGRATED CIRCUIT DEVICE AND METHOD OF MANUFACTURING THE SAME

(71) Applicant: **SK hynix Inc.**, Gyeonggi-do (KR)

(72) Inventors: Jin Ha Kim, Gyeonggi-do (KR); Jun

Kwan Kim, Gyeonggi-do (KR); Kang Sik Choi, Gyeonggi-do (KR); Su Jin Chae, Gyeonggi-do (KR); Young Ho

Lee, Gyeonggi-do (KR)

(73) Assignee: SK Hynix Inc., Gyeonggi-do (KR)

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See application file for complete search history.

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Primary	Examiner — Kim	berly Rizkallah

Assistant Examiner — Kimberiy Kizkalian
Assistant Examiner — Brian Turner
(74) Attorney, Agent, or Firm — I P & T Group LLP

#### (57) ABSTRACT

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A 3D semiconductor integrated circuit device and a method of manufacturing the same are provided. An active pillar is formed on a semiconductor substrate, and an interlayer insulating layer is formed so that the active pillar is buried in the interlayer insulating layer. The interlayer insulating layer is etched to form a hole so that the active pillar and a peripheral region of the active pillar are exposed. An etching process is performed on the peripheral region of the active pillar exposed through the hole by a certain depth, and a space having the depth is provided between the active pillar and the interlayer insulating layer. A silicon material layer is formed to be buried in the space having the depth, and an ohmic contact layer is formed on the silicon material layer and the active pillar.

#### 24 Claims, 7 Drawing Sheets

